TABLE 4-3
TECHNOLOGY SCREENING TABLE – GROUNDWATER
IDENTIFICATION OF CANDIDATE TECHNOLOGIES
RIVERSIDE INDUSTRIAL PARK SUPERFUND SITE
NEW JERSEY

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| No Action | Not Applicable | Not Applicable | Under this response action, no active response action will be taken to address concerns regarding contaminated groundwater. The no action alternative is required to be considered by the NCP to provide a baseline against which all other alternatives may be compared. | Effectiveness: No action would not be effective in reducing toxicity, mobility, or volume for potential source material or principal threat waste and would not meet RAOs.<br>Implementability: Because no action would be taken, this option is the easiest to implement.<br>Relative cost: No capital, administrative, or O&M cost. Lowest cost alternative. | Yes |
| Institutional Controls/Access Restrictions | Use Restrictions | Classification Exception Area (CEA) | Submit to the NJDEP an application with the necessary information to establish a classification exception area, that gives notice of the fact that groundwater in the area does not meet designated use requirements. | Effectiveness: CEAs would not reduce the toxicity, mobility, or volume of contaminants and would not reduce COPC concentrations to protective levels. These controls alone would not be protective of human health because contamination exists at concentrations greater than PRGs. CEAs have been established for some lots to prevent groundwater use for purposes other than monitoring. CEAs will remain in place as long as groundwater does not meet designated use standards.<br>Implementability: CEAs have been established for some lots that bind the property owners to groundwater use restrictions and notice requirements. Designation of additional CEAs may be feasible.<br>Relative cost: Groundwater monitoring and periodic reporting will be required as a component of the CEA. Generally low-cost alternative. | Yes |
| | | Well Restriction Area (WRA) | Typically, part of a classification exception area, the NJDEP establishes a prohibition for installing wells for potable or other uses in the designated area | Effectiveness: WRAs would not reduce the toxicity, mobility, or volume of contaminants and would not reduce COPC concentrations to protective levels. These controls alone would not be protective of human health because contamination exists at concentrations greater than PRGs. Well Restriction Areas (WRAs) have been established for lots with CEAs and will remain in place as long as groundwater does not meet designated use standards.<br>Implementability: Designation of WRAs for additional CEAs would be required.<br>Relative cost: Periodic reporting is required to demonstrate compliance. Generally low-cost alternative. | Yes |
| | Barriers | Fencing/Signage | Sumps in existing buildings and future buildings present opportunities for groundwater exposure into basements. Access restrictions via fencing or secured utility room/vault to restrict access and prevent contact with groundwater and vapors. Warning signs also. | Effectiveness: Fencing and warning signs can be effective in reducing human exposure to contaminated groundwater but do not reduce the toxicity, mobility, or volume of the contamination, which would continue to pose risks to human health and the environment. These controls would not reduce contaminant concentrations to protective levels. May conflict with intended Site use. May be used in conjunction with another technology.<br>Implementability: This process option would be easily implementable for the site since equipment for this process option is readily available.<br>Relative cost: Requires maintenance and monitoring. Periodic inspections and maintenance as required to address damage. Generally low- to moderate-cost alternative. | Yes |
| Engineering Controls | Subsurface Barriers | Slurry Walls | Slurry wall construction typically entails the excavation and backfilling of a trench with either a soil/bentonite or cement/bentonite slurry mixture. Soil/bentonite slurry walls are more flexible, achieve low hydraulic conductivities, and are cheaper than cement/bentonite slurry walls. Where superior strengths are required, cement/bentonite slurry walls can be constructed. To prevent underflow of contaminated groundwater, the slurry walls are typically keyed into underlying confining clay layers within an aquifer. | Effectiveness: Slurry walls are containment barriers applicable to plume control (mobility reduction) and can be used with various technologies and process options to help isolate impacted groundwater and achieve hydraulic control. Due to relatively permeable historic fill and proximity of river, would require surrounding the hydraulic control area to prevent lateral groundwater inflow. A thicker wall than would be typical may be required to resist tidal influence. Existing occupied buildings would limit wall placement and capture area. May be used in combination with the existing or replaced bulkhead wall to isolate the capture area. Based upon subsurface voids along existing river wall between building 6 and 10, and possible wall structure tie backs, slurry wall alignment could be 15-20 feet inland of the present river wall where competent soil (needed for slurry wall trench) is likely to exist. This alignment would result in some soil/fill and groundwater "outside" of slurry wall thus reducing overall effectiveness.<br>Implementability: A slurry wall would be difficult to implement. Active buried infrastructure and building foundations would need to be avoided, removed, or rerouted. Installation may be disruptive to current commercial operations. At some locations (i.e. Buildings 7, 10, and 17) there is insufficient space between river and existing buildings. Geotechnical study of barrier alignment and possible effects on adjacent structures needed.<br>Relative cost: No anticipated maintenance. Generally moderate- to high-cost alternative. | Yes |
| | | Sheet Piling | Sheet pile barrier walls are formed by driving interlocking sheet piles constructed of steel, wood, concrete, or plastic to isolate the contaminated soil from the surrounding environment. As with slurry wall, sheet piling is commonly keyed into lower confining layers to prevent groundwater underflows. | Effectiveness: A barrier would be installed to replace the deteriorated portions of the bulkhead wall to reduce influence of river water on Site groundwater (tidal effects), and reduce potential groundwater exfiltration to river thereby reducing potential mobility of groundwater COPC. Sheet piling would not reduce toxicity or volume. If extended above ground surface, a barrier could also help prevent river flooding, river sediment deposition on Site, infiltration of flood water, and serve as a Site surface water control feature. Inactive river wall pipes would be sealed. Existing occupied buildings would limit wall placement and capture area for inland portions of the Site. May be used in combination with the existing or replaced bulkhead wall to isolate the capture area. At some locations (i.e., Buildings 7, 10, and 17), there are space limitations between the river and existing buildings. If buildings remain, river encroachment is likely.<br>Implementability: Quality control is required to ensure proper interlocking of the sheets. Active buried infrastructure and building foundations could need to be removed, avoided or rerouted. Installation may be disruptive to current commercial operations. Geotechnical study of barrier alignment and possible effects on adjacent structures needed.<br>Relative cost: Requires maintenance to address damage as identified through routine inspection of exposed portions of the barrier. Generally moderate- to high-cost alternative. | Yes |
| | | Grout Curtains | Grout curtains are fixed, subsurface barriers formed by the pressure injection of grout in a regular pattern of drilled holes. Typically, the grout is injected into pipes arranged in a pattern of two or three adjacent rows. The injected grout fills open pore spaces and sets or gels in the soil voids, reducing the permeability of the grouted area. | Effectiveness: Grout curtains are similar to slurry walls although they do not require extensive trenching. Installation and propagation of grout may be difficult in cases of debris fill or heterogeneous subsurface media. Would not be applicable for installation near the river bank due to the potential for grout loss into the river. Due to relatively permeable historic fill and proximity of river, would require surrounding the hydraulic control area to prevent hydraulic communication with the river. Existing occupied buildings would limit curtain placement and capture area. Additionally, existing buried infrastructure may create preferential pathways (i.e., voids and more permeable bedding) preventing a continuous barrier.<br>Implementability: Grout curtains would be somewhat difficult to implement due to buried infrastructure and existing buildings. Treatability studies to design the grout and injection pattern may be required and geotechnical study of barrier alignment and possible effects on adjacent structures. Installation may be disruptive to current commercial operations.<br>Relative cost: No anticipated maintenance. Generally moderate-cost alternative. | No |

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|---|---|---|---|---|---|
| Engineering Controls | Subsurface Barriers | Diaphragm Walls | Diaphragm walls are barriers composed of reinforced concrete panels emplaced by slurry trenching techniques. They may be cast-in-place or pre-cast and are capable of supporting heavy loads. Diaphragm walls can only be expected to have permeabilities comparable to cement/bentonite walls if the joints between the cast panels are made correctly. As with other containment methods, these would have to be keyed into a lower confining layer to prevent groundwater underflow. | Effectiveness: Similar to slurry walls. Due to relatively permeable historic fill and proximity of river, would require surrounding the hydraulic control area to prevent hydraulic communication with the river. Existing occupied buildings would limit wall placement and capture area. May be used in combination with the existing bulkhead wall isolate the capture area. Active existing buried infrastructure would need to be avoided, removed, or rerouted. Installation may be disruptive to current commercial operations. At some locations (i.e. Buildings 7and 10) there is limited space between river and existing buildings. Based upon subsurface voids along existing river wall between building 6 and 10, and possible wall structure tie backs, slurry wall alignment could be 15-20 feet inland of the present wall where competent soil (needed for slurry wall trench) is likely to exist. This alignment would result in some soil/historic fill "outside" of slurry wall.<br>Implementability: Installation generates a large amount of spoils. Installation is difficult where subsurface contains coarse fill. Geotechnical study of barrier alignment and possible effects on adjacent structures needed.<br>Relative cost: Requires maintenance to address damage as identified through periodic inspection. Generally high-cost alternative. Does not offer benefits over other less costly options. | No |
| Removal | Collection Systems | Well Point Dewatering Systems | A well point dewatering system consists of an array of well points (constructed of steel pipes with perforated tips) that are driven into the aquifer and connected at the surface by a manifold hooked up to a vacuum system. | Effectiveness: As a stand-alone technology, well points would not reduce toxicity or volume of COPC but would reduce mobility. For maximum operating efficiency, lift attainable by suction pump is about 22 feet. System design parameters are dependent upon site hydrogeologic conditions. The river presents a boundary condition that will likely hinder the development of a mature cone of depression. To create appropriate capture zones, removed water volumes could be significant due to river influence (recharge). Induced infiltration of river water should be minimized to optimally address impacted groundwater by selective well point placement and possible installation of a subsurface barrier between the well points and river. Typically used for short-term withdrawal in preparation for soil excavation (i.e., manifold and pipes are not buried for freeze protection and well points may lose efficiency from biological fouling or sedimentation). No perceived benefit to removal of groundwater using well points vs. removal directly from an excavation, except for possible reduction of suspended solids via in situ filtration through the formation.<br>Implementability: Well points would be relatively easy to install and add or replace as needed for effective dewatering on a temporary basis.<br>Relative cost: Requires a continuous power source, vacuum blower, and well point maintenance. Ongoing operation and maintenance activities. Generally low-cost alternative. | No |
| | | Ejector Wells | Ejector well construction specifications are similar to those of well points. Pumping and extraction of groundwater is achieved by bubbling air upward through the well casing and allowing the air pressure to lift the groundwater to the surface. Ejector wells are applicable for high-lift, low-flow conditions. | Effectiveness: As a stand-alone technology, wells would not reduce toxicity or volume of COPC, but would reduce mobility. Ejector wells have very low operating efficiencies. System design parameters are dependent upon site hydrogeologic conditions. The river presents a boundary condition that will likely hinder the development of a mature cone of depression. To create appropriate capture zones, removed water volumes could be significant due to river influence (recharge). Due to inherent low-flow capability and anticipated recharge rates due to river proximity, well spacing would be relatively close. Induced infiltration of river water should be minimized to optimally address impacted groundwater by selective well screen placement and possible installation of a subsurface barrier between the wells and river. Not applicable for this setting due to shallow groundwater (i.e., high-lift not required).<br>Implementability: Ejector wells would be readily implemented with conventional drilling contractors.<br>Relative cost: Requires a continuous power source, compressor, ejector well maintenance. Ongoing operation and maintenance activities. Generally low-cost alternative. | No |
| | | Pumping Wells | Pumping wells are similar to traditional wells and are installed in a boring consisting of riser casing, well screen, and sand filter pack. The wells can be installed at regular intervals across a site to allow for the overlapping of the cones of depression (capture zones) created by simultaneous pumping to achieve the collection of contaminated groundwater and halt the migration of a plume. | Effectiveness: As a stand-alone technology, wells would not reduce toxicity or volume of COPC, but would reduce mobility. System design parameters are dependent upon site hydrogeologic conditions. The river presents a boundary condition that will likely hinder the development of a mature cone of depression. To create appropriate capture zones, removed water volumes could be significant due to river influence (recharge). Induced infiltration of river water should be minimized to optimally address impacted groundwater by selective well screen placement and possible installation of a subsurface barrier between the wells and river. There are no unacceptable health risks under the current use and CEAs are anticipated for those lots currently without one to prevent groundwater use for other than monitoring Groundwater concentrations of some COPCs were lower for the last event than prior events. Pump and treat options may address organic COPC but would not eliminate ongoing dissolution of inorganic COPC to groundwater that remains in contact with urban fill or remaining contaminated soils.<br>Implementability: Wells would be readily implemented with conventional drilling contractors. Requires a continuous power source, pump, and well maintenance. Ongoing operation and maintenance activities.<br>Relative cost: Generally moderate-cost alternative. | Yes |
| Removal | Collection Systems | Subsurface Drains | Subsurface drains include any type of buried conduit used to convey and collect groundwater by gravity flow. They function like an infinite line of extraction wells, creating a continuous zone of influence enabling groundwater within these zones to flow toward the drain. Subsurface drains installed along a line or at regular intervals across a site are constructed by trench excavation in the aquifer of concern, placement of a perforated drainage pipe in the base of the trench, and backfilling of the trench with aggregate. The individual drain pipes subsequently drain into a collection sump, which can be emptied (pumped) periodically. | Effectiveness: As a stand-alone technology, drains would not reduce toxicity or volume of COPC, but would reduce mobility. Subsurface drains are most effective for shallow depths of less than 20 feet. System design parameters are dependent upon site hydrogeologic conditions. The river presents a boundary condition that will likely hinder the development of a mature cone of depression. To create appropriate capture zones, removed water volumes could be significant due to river influence (recharge). Induced infiltration of river water should be minimized to optimally address impacted groundwater by selective well screen placement and possible installation of a subsurface barrier between the wells and river. There are no unacceptable health risks under the current use and CEAs are anticipated for those lots currently without one to prevent groundwater use for other than monitoring. Groundwater concentrations of some COPCs were lower for the last event than prior events. Pump and treat options may address organic COPC but would not eliminate ongoing dissolution of inorganic COPC to groundwater that remains in contact with urban fill or remaining contaminated soils.<br>Implementability: Wells would be readily implemented with conventional trenching equipment and pipe contractors.<br>Relative cost: Disposal of cuttings required. Requires a continuous power source, ongoing pump, and sediment flushing/removal from collection pipes and sumps. Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative | Yes |

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**TECHNOLOGY SCREENING TABLE – GROUNDWATER**
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**RIVERSIDE INDUSTRIAL PARK SUPERFUND SITE**
**NEW JERSEY**

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| Treatment | Ex-Situ (Physical) | Coagulation, flocculation, and sedimentation | Coagulation, flocculation, and sedimentation are the combination of three processes for the removal of solids in water. Sedimentation is the separation of suspended particles that are heavier than water by gravitational settling. Coagulation is a chemical technique directed towards the destabilization of colloidal particles in the water into larger particles which can settle out. Flocculation is a slow mixing technique which promotes the agglomeration of the destabilized particles to precipitate out of the water. | Effectiveness: As a stand-alone technology, these processes would not reduce toxicity or volume of COPC but would reduce mobility. Coagulation, flocculation, and sedimentation are an integral part of any aqueous treatment system and are used specifically for the removal of suspended solids. Reduction of toxicity and volume of organics and dissolved inorganics will also require treatment via other physical or chemical processes. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists. May require bench scale/pilot studies during design. Following start-up of possible extraction options, total suspended solids concentrations should be manageable with other options to avoid addition of coagulants.<br>Relative cost: Requires a continuous power source, mixing and settling tanks, chemical additives, chemical metering, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate-cost alternative. | No |
| | | Filtration | Filtration is the separation and removal of suspended solids from a liquid by passing the liquid through a porous medium comprised of a fibrous fabric, a screen, or a bed of granular material. To aid filtration, ground cellulose or diatomaceous earth is commonly added to the filter medium. Fluid flow through the filter media may be accomplished by gravity, by inducing partial vacuum on one side of the medium, or by exerting a mechanical pressure on a dewatered sludge enclosed by filter media. | Effectiveness: As a stand-alone technology, filtration would not reduce toxicity or volume of COPC, but would reduce mobility. Filtration is used primarily to remove any residual suspended solids remaining in the water following coagulation/sedimentation. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping for elevation/pressure head, replacement or backwashing of filter media, off-site disposal of removed solids, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate-cost alternative. | Yes |
| | | Granular Activated Carbon | Chemical contaminants can be removed from water by the physical and chemical adsorption of organics onto the surface of carbon particles. Wastewater is pumped through a bed of granular activated carbon where close contact with carbon particles promotes adsorption of contaminants. Carbon adsorption removes a broad range of organic contaminants and a select number of inorganic contaminants. The exhausted carbon must be removed for disposal or regeneration. | Effectiveness: Carbon adsorption would reduce COPC mobility but would not reduce toxicity or volume. The technology is very effective for the removal of VOCs and achieves a high level of contaminant removal. Operational guidelines for this technology are that contaminant concentrations should be less than 10,000 parts per million (ppm) with suspended solids less than 50 ppm. Reduction of dissolved inorganics may require treatment via other physical or chemical processes. Ongoing operation and maintenance activities. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists.<br>May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping for elevation/pressure head, backwashing of filter media, replacement and off-site disposal or regeneration of spent carbon, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Generally moderate- to high-cost alternative. | Yes |
| | | Ion Exchange | Ion exchange is a process by which ions of a given species are displaced from an insoluble exchange material by ions of a different species in solution. Ion exchangers can be operated in either a batch or a continuous mode. Spent resin is usually regenerated by exposing it to a very concentrated solution of the original exchange ion, enabling a reverse exchange to take place, resulting in regenerated resin and a concentrated solution of the removed ion which can then be processed for recovery and reuse. | Effectiveness: The process is used to treat metal-containing wastes including cations and anions and certain organic substances. Ion exchange would reduce COPC mobility but would not reduce toxicity or volume. Limitations to the ion exchange process are compound selectivity/competition, pH, and suspended solids. High solid concentrations sometimes lead to resin blinding and diminishing efficiency. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists and proprietary products. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping for elevation/pressure head, replacement and off-site disposal or regeneration of spent exchange media, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative. | No |

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**NEW JERSEY**

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| Treatment | Ex-Situ (Physical) | Chelation | Chelation is a chemical process in which ionic species, such as cationic metals, form coordination bonds with ions or molecules called ligands, modifying the properties of the metal ions. Ligands attached to insoluble species or matrices would have the effect of tying metals to the solid phase. When the removal capacity is saturated, the medium must be regenerated or replaced. | Effectiveness: Chelation would not reduce COPC toxicity or volume but would reduce mobility. The process is used to treat metal-containing waters. Limitations to the process are compound selectivity/competition, pH, and suspended solids. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists and proprietary products. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping for elevation/pressure head, replacement and off-site disposal or regeneration of chelation medium, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative. | No |
| | | Air Stripping | Air stripping is a mass transfer process in which volatile contaminants in water are transferred into the air. Air stripping is frequently accomplished in a packed tower equipped with an air blower. The factors important in the removal of organics from water include Henry's Law constants, temperature, pressure, air-to-water ratios, and the surface area available for mass transfer. | Effectiveness: Air stripping would not reduce COPC toxicity, mobility or volume. Air stripping is most effective for the removal of VOCs as a pretreatment step prior to activated carbon. The recovery of volatilized hazardous gases by means of emission control apparatuses may be required for subsequent treatment. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: This technology would be implemented with moderate difficultly via water treatment specialists. Air permits may be required. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, aerator pumping, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative. | No |
| | | Steam Stripping | Steam stripping uses steam to evaporate VOCs from aqueous waste streams. Stream stripping is essentially a continuous fractional distillation process carried out in a packed or tray tower. Clean steam provides direct heat to the column in which gas flows from the bottom to the top of the tower. The resulting residuals are contaminated steam condensate, recovered solvent, and stripped effluent. The organic vapor and the bottoms would require further treatment. | Effectiveness: Steam stripping will not be effective for inorganic COPC but will treat less volatile and more soluble organic wastes than will air stripping and can handle concentrations from less than 100 ppm to approximately 10 percent organics. Would not reduce COPC toxicity, mobility or volume.<br>Implementability: This technology would be implemented with moderate difficultly. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, steam generation, disposal of recovered solvent, vapor and bottoms treatment, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally high-cost alternative. Does not offer benefits over other less costly options. | No |
| | | Critical Fluid Extraction | Critical fluid extraction involves extraction of the aqueous constituents using a solvent and subsequent separation of the solvent and organics with reuse of the solvent. The aqueous stream enters near the top of an extractor, while the solvent is fed countercurrently into the bottom. At or near the gas' critical point, the organics in the aqueous stream dissolve into the solvent. Organic-laden extract can then be removed from the top of the column while clean water exits from the bottom. The extract then goes to a separator, where the temperature and pressure are decreased, causing the organics to separate from the solvent which is recycled and returned to the extractor. | Effectiveness: Critical fluid extraction can remove chlorinated hydrocarbons, phenols, benzene and its derivatives, alcohols, ketones, acids, oil, and greases. Would not reduce COPC toxicity or volume but would reduce mobility.<br>Implementability: This technology would be implemented with moderate difficultly. May require bench scale/pilot studies during design. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Relative cost: Requires a continuous power source, pumping, heating, solvent metering, organics disposal, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities Generally high-cost alternative. Does not offer benefits over other less costly options. | No |
| | | Reverse Osmosis | Reverse osmosis uses a semipermeable membrane which will allow the passage of only certain components of a solution and a driving force to separate these components at a useful rate. The membrane is permeable to the solvent (groundwater), but impermeable to most dissolved organics and inorganics. | Effectiveness: Reverse osmosis may be used to concentrate dilute solutions of many inorganic and some organic solutes. Would not reduce COPC toxicity or volume but would reduce mobility. Reprocessing may be necessary to optimize pH, remove strong oxidants, and filter out suspended solids.<br>Implementability: This technology would be implemented with moderate difficultly. May require bench scale/pilot studies during design. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Requires a continuous power source, pumping, disposal of filter residue, membrane maintenance, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Reverse osmosis is a high-cost treatment alternative, suitable for low volume applications. Does not offer benefits over other less costly options | No |
| | | Oil-Water Separation | Gravitational forces are used to separate two or more immiscible liquids having sufficiently different densities. Flow rates in continuous processes are kept low to enable liquid/liquid separation when the liquid mix is allowed to settle. Floating oil can be skimmed off the top using an oil skimmer, while the water flows out of the lower portion of the chamber. Acids may be used to break an oil/water emulsion and enhance separation to allow for greater oil removal efficiencies. | Effectiveness: Oil-water separation is usually a pretreatment process whose effectiveness is influenced by the aqueous waste stream's flow rate, temperature, and pH. Ongoing operation and maintenance activities.<br>Because free-phase product has not been observed in groundwater monitoring wells, this process option will be screened out.<br>Implementability: May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, disposal of free-phase product, and monitoring of discharge. May also require metering of acid and neutralization. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Generally moderate-cost alternative. | No |

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|---|---|---|---|---|---|
| Treatment | Ex-Situ (Physical) | Thickening/Dewatering | Thickening/dewatering is a process used to increase the solids content of sludge by removing a portion of the liquid fraction by such unit processes as filtration, etc. | Effectiveness: The process is generally proposed for wastewater treatment sludges (such as those that may be generated from a pump-and-treat system). There are no unacceptable health risks under the current use and CEAs are anticipated for those lots currently without one to prevent groundwater use for other than monitoring. RIR evidence suggests that cessation of illegal dumping has improved groundwater quality. Pump and treat options may address organic COPC, but would not eliminate dissolution of inorganic COPC to groundwater that remains in contact with urban fill. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: May require bench scale/pilot studies during design. Sludge generation from ex-situ biological treatment could be thickened prior to disposal.<br>Relative cost: Requires a continuous power source, pumping, sludge disposal, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally low-cost alternative. | No |
| | Ex-Situ (Chemical) | Neutralization | Neutralization is the interaction of an acid with a base to enable the adjustment of the pH to 7.0, at which level the concentrations of hydrogen and hydroxyl ions are equal. | Effectiveness: The process is generally proposed for wastewater treatment. Because pH of site groundwater is near neutral, this option is not applicable unless other treatment process options significantly alter pH (e.g., chemical precipitation) or acidic off-gases are generated (e.g., incineration or pyrolysis).<br>Implementability: May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, metering of neutralizer, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally low-cost alternative. | No |
| | | Chemical Oxidation | Chemical oxidation by mixing oxidizing agents such as hydrogen peroxide, sodium and potassium permanganate, ozone, sodium and potassium persulfate. Most organic contaminants are amenable to oxidation. | Effectiveness: Would reduce toxicity, mobility, and volume of organic COPC in groundwater. Ambient oxidant demands must be estimated, to develop a proper dosing regimen. Chemical oxidation would likely be an ancillary technology to another form of treatment as a component of an alternative.<br>Implementability: Would be implemented with moderate difficulty using conventional containment and pumps, and potentially proprietary treatment agents. Bench scale testing and treatability/pilot study may be required during design.<br>Relative cost: Requires a continuous power source, pumping, metering of oxidizer, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate-cost alternative. | Yes |
| | | Chemical Precipitation | Chemical precipitation is widely used for the removal of heavy metals wherein the chemical equilibrium of a waste is changed through the addition of an acid or alkali to reduce the solubility of the undesired components. This causes them to precipitate out of solution in the form of colloidal or solid particulates. | Effectiveness: The process is limited in that not all metals have a common pH at which they precipitate. Chelating and complexing agents can interfere with the precipitation process. Ongoing operation and maintenance activities.<br>As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, disposal of precipitate, and metering of neutralizer, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Generally moderate-cost alternative. | Yes |
| | | Ultraviolet/Hydrogen Peroxide | Ultraviolet radiation is electromagnetic radiation that has a wavelength shorter than visible, but longer than x-ray radiation. Ultraviolet radiation causes the rearrangement of molecular structures resulting in the formation of new chemical compounds. Hydrogen peroxide is an unstable, highly reactive oxidizing agent which, when coupled with the ultraviolet radiation, has been shown to be successful in the degradation of certain organics. | Effectiveness: Ultraviolet/hydrogen peroxide is generally restricted to waters with a 1% or lower concentration of hazardous contaminants, or contaminants that are not easily oxidized by conventional methods.<br>Implementability: May require pre-filtering to reduce turbidity. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, UV bulb maintenance, metering of hydrogen peroxide, and monitoring of discharge. Requires regular O&M support, and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative. Does not offer benefits over other options for oxidation of site contaminants and requires use of a hazardous substance (hydrogen peroxide). | No |
| | Ex-Situ (Biological) | Suspended Growth - Activated Sludge | The activated sludge process only treats aqueous organic waste streams having less than a 1% suspended solids content. During the process, organic contaminants in the aqueous wastes are broken down through the activity of aerobic microorganisms which metabolize biodegradable organics. The treatment includes conventional activated sludge processes, as well as modifications such as sequencing batch reactors. The aeration process includes pumping the aqueous waste into an aeration tank where the biological treatment occurs. This is followed by the stream being sent to a clarifier where the treated aqueous waste is separated from the sludge biomass. | Effectiveness: Activated sludge processes are not suitable for removing highly chlorinated organics, aliphatics, amines, and aromatic compounds from an aqueous waste stream. Reduction of dissolved inorganics will require treatment via other physical or chemical processes. Some heavy metals and organic chemicals can be harmful to the microorganisms. The influent should contain a suitable ratio of carbon, nitrogen and phosphorous. Generally requires a relatively large system due to long retention times (typically several hours). As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: Due to presence in groundwater of heavy metals (arsenic, lead, chromium) and aromatics (4-methylphenol) that may hinder activated sludge growth, and anticipated variability in influent contaminant and sodium chloride concentrations due to fluctuating water table from tidal influence, this option may require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, disposal of sludge, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Ongoing operation and maintenance activities. Generally moderate-cost alternative. | No |

TABLE 4-3
TECHNOLOGY SCREENING TABLE – GROUNDWATER
IDENTIFICATION OF CANDIDATE TECHNOLOGIES
RIVERSIDE INDUSTRIAL PARK SUPERFUND SITE
NEW JERSEY

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| Treatment | Ex-Situ (Biological) | Fixed Film Growth - Rotating Biological Contactor, Trickling Filters. | Rotating biological contactors employ microorganisms attached to a fixed medium that is rotated through the aqueous waste stream in a closed reactor. In a trickling filter, the influent wastewater is distributed over fixed media that serve as a substrate for the microbes. The fixed film growth systems aerobically treat aqueous waste streams containing alcohols, phenols, phthalates, cyanide, and ammonia. | Effectiveness: The fixed film growth systems are essentially applicable to the same waste streams as the activated sludge treatment process. Ongoing operation and maintenance activities. As indicated for removal technologies, pump and treat options would offer marginal improvement of groundwater quality and are not carried forward for detailed analysis.<br>Implementability: Due to presence in groundwater of heavy metals (arsenic, lead, chromium) and aromatics (4-methylphenol) that may hinder activated sludge growth, and anticipated variability in influent contaminant and sodium chloride concentrations due to fluctuating water table from tidal influence, this option may require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, pumping, disposal of sludge, and monitoring of discharge. Requires regular O&M support and depending on flows and treatment complexity could be continuous (i.e., 24/7). Generally moderate-cost alternative. | No |
| | Ex-Situ (Thermal) | Liquid Injection Incineration | Liquid injection incinerators are usually cylindrical refractory secondary combustors for low-calorific material. Liquid wastes are introduced to the combustion chamber by means of specifically designed nozzles that mix with air and fuel as needed. The resulting gases, following combustion, are collected and treated to remove particulates and to neutralize acid gases. Pretreatment may be required for feeding some aqueous wastes to specific nozzles to provide efficient mixing with the oxygen source and to maintain a continuous waste flow. | Effectiveness: The burners are susceptible to clogging by particulates or caked material at the nozzles. Heavy metal wastes and wastes having high inorganic contents are not suitable for treatment.<br>Implementability: Would be difficult to implement for Site groundwater due to specialty knowledge and equipment. May require bench scale/pilot studies during design. Off-gas treatment and permitting may be required.<br>Relative cost: Requires significant energy input, pumping, pre-treatment solids removal, airborne particulate removal, acid gas neutralization, disposal of captured particulates and ash, and air monitoring. Requires continuous (i.e., 24/7) attendance and monitoring during operation. Ongoing operation and maintenance activities. Generally high-cost alternative. | No |
| | | Pyrolysis | Pyrolysis is the chemical decomposition of wastes accomplished in an oxygen- deficient atmosphere. The system involves the use of two chambers. The separation of the volatile components from the nonvolatile components and ash is achieved in the primary chamber (pyrolyzer). In the secondary combustion chamber, volatile components are burned under proper operating conditions to destroy any remaining hazardous components. Temperatures in the pyrolyzer range from 1,000 to 1,300° F. | Effectiveness: Pyrolysis is only applicable to wastes containing pure organics. Systems are usually designed for specific wastes and are not readily adaptable to a variety of wastes. In addition, pyrolysis of chlorinated organics can lead to the formation of hazardous products of incomplete combustion (PICs).<br>Implementability: Would be difficult to implement for Site groundwater due to specialty knowledge and equipment. Off-gas treatment and permitting may be required. May require bench scale/pilot studies during design.<br>Relative cost: Requires significant energy input, pumping, pre-treatment solids removal, airborne particulate removal, acid gas neutralization, disposal of captured particulates and ash, and air monitoring. Requires continuous (i.e., 24/7) attendance and monitoring during operation. Ongoing operation and maintenance activities. Generally high-cost alternative. | No |
| | | Wet Air Oxidation | Wet air oxidation uses high-temperature oxidation under controlled conditions to destroy dissolved or suspended organic waste constituents, oxidizable inorganics, and wastes not readily amenable to biological treatment. Aqueous phase oxidation of organic constituents is achieved at temperatures between 350 and 650°F and pressures ranging from 300 to 3,000 pounds per square inch (psi). Liquid wastes are pumped into the system and are mixed with compressed air or oxygen. The air-waste mixture then passes through a heat exchanger before entering the reactor, where the oxygen in the air reacts with organic constituents in the waste. The gas and liquid phase are separated following oxidation. | Effectiveness: Wet air oxidation is not suitable for inorganics or for wastes containing low concentrations of organics.<br>Implementability: Off-gas treatment and permitting may be required. May require bench scale/pilot studies during design.<br>Relative cost: Requires significant energy input, pumping, pre-treatment solids removal, airborne particulate removal, acid gas neutralization, disposal of captured particulates and ash, discharge and air monitoring. Requires continuous (i.e., 24/7) attendance and monitoring during operation. Ongoing operation and maintenance activities. Generally high-cost alternative. | No |
| | In-Situ (Biological) | Bioremediation | Bioremediation is a process used to treat contaminated groundwater by altering environmental conditions to stimulate growth of microorganisms that degrade the target contaminants. Most bioremediation processes involve oxidation-reduction reactions where either an electron acceptor is added to stimulate oxidation of a reduced contaminant (e.g. hydrocarbons) or an electron donor is added to reduce oxidized pollutants (e.g., chlorinated solvents). In both cases additional nutrients, and pH buffers may need to be added to optimize conditions for the microorganisms. In some cases, specialized microbial cultures are added (bioaugmentation) to further enhance biodegradation | Effectiveness: Aerobic and anaerobic bioremediation are well understood and documented. Would reduce volume, toxicity, and mobility of groundwater organic COPC. Amendments and deliverable methods are widely available. Relies on indigenous microorganisms.<br>Implementability: Due to presence in groundwater of heavy metals (arsenic, lead, chromium) and aromatics (4-methylphenol) that may hinder biological growth, and anticipated variability in influent contaminant and sodium chloride concentrations due to fluctuating water table from tidal influence, this option may require bench scale/pilot studies during design.<br>Relative cost: Requires groundwater monitoring and possibly periodic nutrient/pH buffer reinjection. Generally low- to moderate-cost alternative. | Yes |
| | | Biosparging | Air is pumped at low rates through well points, to stimulate aerobic bioremediation. | Efficiency: Would reduce volume, toxicity, and mobility of groundwater organic COPC. The method is well understood, and tools and equipment are readily available. Efficacy is susceptible to site hydrogeologic conditions, such as air permeability and homogeneity. Relies on indigenous microorganisms..<br>Implementability: Due to presence in groundwater of heavy metals (arsenic, lead, chromium) and aromatics (4-methylphenol) that may hinder biological growth, and anticipated variability in influent contaminant and sodium chloride concentrations due to fluctuating water table from tidal influence, this option may require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous power source, aeration, well point maintenance, groundwater monitoring, and possibly periodic nutrient/pH buffer reinjection. Ongoing operation and maintenance activities. Generally moderate-cost alternative. | Yes |

TABLE 4-3
TECHNOLOGY SCREENING TABLE – GROUNDWATER
IDENTIFICATION OF CANDIDATE TECHNOLOGIES
RIVERSIDE INDUSTRIAL PARK SUPERFUND SITE
NEW JERSEY

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| Treatment | In-Situ (Physical) | Immobilization | Nano-scale activated carbon slurry is injected in the subsurface to provide binding sites for organic contaminants. This supports the development of biofilms and the enhanced biodegradation of organic contaminants | Effectiveness: This is an innovative technology with a good performance record. Would reduce mobility of groundwater COPC but would not reduce toxicity or volume.<br>Implementability: Due to low absorption efficiency of some soluble inorganics in aqueous solution, assessment of Site geochemistry and mobility of inorganics may be required for design. May require bench scale/pilot studies during design.<br>Relative cost: Requires groundwater monitoring, and possibly multiple slurry injections. Generally moderate-cost alternative. | Yes |
| | | Air Sparging | In-situ air sparging of the site groundwater would be conducted by constructing sparge points (wells) to the appropriate depths into the contaminated groundwater. Aeration would be provided at each sparge point by blowers/compressors and, as necessary, an aboveground header/distribution system. A soil vapor extraction system (SVE) (vents and vacuum blowers) with off-gas treatment could be used to attempt to capture VOC-laden air from the vadose zone above the sparge point system. Emissions controls (off gas treatment) would be required on the SVE exhaust. | Effectiveness: Air sparging is effective in removing VOCs from the groundwater. Efficacy is susceptible to site hydrogeologic conditions, such as air permeability and homogeneity. Due to high water table (i.e., 4 to 10 feet below ground surface) and corresponding thin vadose zone, short-circuiting of a vacuum recovery system (SVE) to the atmosphere is likely without an impermeable cover layer, leading to substantially reduced collection efficiency. In addition, due to fluctuating water table, vaporized contaminants in the vadose zone at low tide could re-enter the aqueous phase at high tide, reducing overall efficiency.<br>Implementability: Air sparging would be readily implemented with conventional installation methods and equipment. May require bench scale/pilot studies during design.<br>Relative cost: Requires maintenance of sparge (and extraction) points, a continuous source of energy, compressors (and blowers), groundwater monitoring, and possibly periodic nutrient/pH buffer reinjection. Ongoing operation and maintenance activities. Generally moderate-cost alternative. | Yes |
| | | In-Well Vapor Stripping | In-well vapor stripping technology involves the creation of a groundwater circulation pattern and simultaneous aeration within the stripping well to volatilize VOCs from the circulating groundwater. Air-lift pumping is used to lift groundwater and strip it of contaminants. Contaminated vapors may be drawn off for aboveground treatment or released to the vadose zone for biodegradation. Partially treated groundwater is forced out of the well into the vadose zone where it reinfiltrates to the water table. Untreated groundwater enters the well at its base, replacing the water lifted through pumping. Eventually, the partially treated water is cycled back through the well until contaminant concentration levels are reduced. | Effectiveness: Would reduce volume, toxicity, and mobility of groundwater organic COPC. Applications of in-well stripping have generally involved chlorinated organic solvents (e.g., trichloroethene) and petroleum product contamination (e.g., benzene, toluene, ethylbenzene, xylene [BTEX], total petroleum hydrocarbon [TPH]). In-well stripping has been used in a variety of soil types from silty clay to sandy gravel. Efficacy is susceptible to site hydrogeologic conditions, especially mesoscale lithologic variability and preferential pathways. Due to high water table (i.e., 4 to 10 feet below ground surface) and corresponding thin vadose zone, there is little opportunity for vadose zone biodegradation. Also, short-circuiting of a vacuum recovery system (SVE) to the atmosphere is likely without an impermeable cover layer, leading to substantially reduced collection efficiency.<br>Implementability: In well vapor stripping would be implemented with moderate difficulty. May require bench scale/pilot studies during design.<br>Relative cost: Requires a continuous source of energy, pumping, maintenance of well screens, and groundwater monitoring, and possibly periodic nutrient/pH buffer reinjection. Ongoing operation and maintenance activities. Generally moderate- to high-cost alternative. | No |
| | In-Situ (Chemical) | Treatment Walls | Treatment walls involve construction of permanent, semi-permanent, or replaceable units across the flow path of a contaminant plume. As the contaminated groundwater moves passively through the treatment wall, the contaminants are removed by physical, chemical, and/or biological processes, including precipitation, sorption, oxidation/reduction, fixation, or degradation. These simple mechanical barriers may contain metal-based catalysts, chelating agents, nutrients and oxygen, or other agents that are placed either in the path of the plumes to prevent further migration or immediately downgradient of the contaminant source to prevent plume formation. | Effectiveness: Would reduce mobility but may not reduce toxicity or volume. Treatment walls can be designed for the abatement of metals and VOCs. An important uncertainty in this option is the operating life of the in-situ removal technology (carbon adsorption and/or ion exchange and/or zero-valence metals) and the feasibility of replacing or regenerating this capacity when exhausted. Due to fluctuating water table and flow direction in response to tidal influence, impacted groundwater may not reach the wall without pumping to induce hydraulic gradient.<br>Implementability: Would be implemented with moderate difficulty using conventional earthmoving equipment and possibly proprietary treatment agents. May require bench scale/pilot studies during design.<br>Relative cost: Requires groundwater monitoring and possible replacement of treatment medium or biological amendments. Generally moderate- to high-cost alternative. | No |
| | | Chemical Precipitation | An array of injection wells or mechanical mixing is used to introduce iron sulfide or other fixative agent. Dissolved heavy metals then precipitate and substitute for iron within an iron sulfide lattice. | Effectiveness: The process is limited in that not all metals will chemically react with iron sulfide. Chelating and complexing agents can interfere with the precipitation process.<br>Implementability: May require bench scale/pilot studies during design.<br>Relative cost: May require multiple additions to achieve desired results. Generally moderate-cost alternative. | Yes |
| | | Funnel and Gate | The funnel-and-gate system for in-situ treatment of contaminated plumes consists of low hydraulic conductivity (e.g., $1 \times 10^{-6}$ cm/s) cutoff walls with gaps that contain in-situ reaction zones. Cutoff walls (the funnel) modify flow patterns so that groundwater primarily flows through high conductivity gaps (the gates). The type of cutoff walls most likely to be used in the current practice are slurry walls, sheet piles, or soil admixtures applied by soil mixing or jet grouting. | Effectiveness: See above comments for subsurface barriers and treatment walls. Due to fluctuating water table and flow direction in response to tidal influence, impacted groundwater may not reach the gate without pumping to induce hydraulic gradient.<br>Implementability: Would be implemented with moderate difficulty using conventional earthmoving equipment and potentially proprietary treatment agents. May require bench scale/pilot studies during design.<br>Relative cost: Requires groundwater monitoring and possible replacement of treatment medium or biological amendments. Generally moderate- to high-cost alternative. | No |
| | | In-situ Chemical Oxidation (ISCO) | An array of injection wells or direct push points is used to introduce oxidizing agents such as hydrogen peroxide, sodium and potassium permanganate, ozone, sodium and potassium persulfate. Most organic contaminants are amenable to oxidation. | Effectiveness: Would reduce toxicity, mobility, and volume of organic COPC in groundwater. A wide array of reagents and delivery tools are available. Ambient oxidant demands must be estimated, to develop a proper dosing regimen.<br>Implementability: Would be implemented with moderate difficulty using conventional drilling or excavating equipment and potentially proprietary treatment agents. Bench scale testing and treatability/pilot study may be required during design.<br>Relative cost: Requires groundwater monitoring and possibly multiple slurry injections. Generally moderate-cost alternative. | Yes |
| | | In-situ Chemical Reduction (ISCR) | Similar to ISCO, but a reductant, such as calcium polysulfide, is utilized to develop reducing geochemical conditions that favor the immobilization of certain multivalent metals, such as chromium. | Effectiveness: Would reduce mobility of certain inorganic COPC and decrease volume and toxicity of certain organic COPC in groundwater. Ambient oxidant demands must be estimated to develop a proper dosing regimen.<br>Implementability: Would be implemented with moderate difficulty using conventional drilling or excavating equipment and potentially proprietary treatment agents. May require bench scale/pilot studies during design.<br>Relative cost: Requires groundwater monitoring and possibly multiple slurry injections. Generally moderate- to high-cost alternative. | Yes |

**TABLE 4-3**
**TECHNOLOGY SCREENING TABLE – GROUNDWATER**
**IDENTIFICATION OF CANDIDATE TECHNOLOGIES**
**RIVERSIDE INDUSTRIAL PARK SUPERFUND SITE**
**NEW JERSEY**

| GENERAL RESPONSE ACTION | REMEDIAL TECHNOLOGY | PROCESS OPTIONS | DESCRIPTION | SCREENING COMMENTS (Effectiveness, Implementability, and Relative Cost) | RETAINED |
|---|---|---|---|---|---|
| Monitored Natural Attenuation | Continued Monitoring | Not Applicable | Natural Attenuation would involve the demonstration that natural processes can remove and/or attenuate migration of site contaminants. Natural attenuation differs from "no action" in that natural attenuation is implemented only if it can be demonstrated and proven that natural attenuation will reduce the contaminant levels to meet ARARs. Metals would be attenuated by, precipitated on, and/or adsorbed to, aquifer materials. VOCs would be adsorbed to aquifer materials or biodegraded. Due to the potential for migration of contaminants, a site-specific demonstration of its applicability is needed. This demonstration would involve periodic sampling and analyses on a monitoring well network (existing and supplemented with additional wells) for contaminants of concern as well as indicator parameters for natural attenuation. Appropriate modeling would be conducted to demonstrate attenuation of contaminants based upon monitoring data. | Effectiveness: Monitored Natural Attenuation is often implemented as the final step, following application of another treatment methods, such as bioremediation, ISCR, or ISCO. LNAPL has been identified in soil at one temporary well point. MNA will not apply to free-phase product or residual product, should they be identified in groundwater. Groundwater concentrations of some COPCs were lower for the last event than prior events. Natural attenuation may be a factor in this finding.<br>Implementability: MNA would be readily implemented.<br>Relative cost: Requires groundwater monitoring. Generally low-cost alternative. | Yes |
| Disposal | Disposal (off-site) | Discharge to Local POTW | In this option, groundwater would be routed to a nearby POTW using the existing Site conveyance system following pretreatment as required to comply with the facility's pretreatment standards. | Effectiveness: At present, this option is feasible, assuming that the POTW's requirements (i.e., hydraulic and treatment capacity) can be met. Would be considered for temporary dewatering activities only.<br>Implementability: Would require thorough water quality characterization for POTW approval.<br>Relative cost: Requires discharge monitoring and usage fees. Generally low- to high-cost alternative. | Yes |
| | | Disposal to Off-Site TSDF | This option entails off-site hauling of groundwater treated to the levels necessary for acceptance at an approved off-site TSDF. | Effectiveness: Would be effective for reducing mobility, toxicity, and volume of groundwater COPC. Locating an appropriate TSDF is required. Would be considered for temporary dewatering activities only.<br>Implementability: Would require thorough water quality characterization for TSDF approval.<br>Relative cost: Requires discharge monitoring and transport and usage fees. Generally moderate- to high-cost alternative. | No |
| | Disposal (on-site) | Discharge to Surface Water | In this disposal option, treated groundwater would be directly discharged to the active storm water conveyance system at the site. | Effectiveness: This option would not reduce toxicity, mobility, or volume of groundwater COPC without prior treatment, but could reduce potential exposure. This disposal option is feasible assuming that direct discharge effluent quality requirements can be met.<br>Implementability: Direct discharge could be implemented through compliance with the substantive portions of the NPDES permitting process.<br>Relative cost: Requires discharge monitoring. Generally low- to moderate-cost alternative. | Yes |
| | | Reinjection | Reinjection involves recharge of treated groundwater to the subsurface for plume recovery. | Effectiveness: This option would not reduce toxicity, mobility, or volume of groundwater COPC without treatment. Reinjection for plume recovery must occur outside the plume boundaries to be effective. System design parameters are dependent upon site hydrogeologic conditions. Well performance may degrade with time. Due to thin vadose zone and possible upwelling of reinjected groundwater to the surface increasing potential for exposure, this option is not applicable.<br>Implementability: Reinjection would be readily implementable with conventional drilling methods and available equipment.<br>Relative cost: Requires discharge monitoring and injection well maintenance. Generally low- to moderate-cost alternative. | No |